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LACQUERS AND PAINTS. METHOD FOR DETERMINING WEATHER-RESISTANCE --ETC(U)  
JUL 79

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FOREIGN TECHNOLOGY DIVISION



LACQUERS AND PAINTS. METHOD FOR DETERMINING WEATHER-  
RESISTANCE OF COATINGS



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ADA079934

FTD -ID(RS)T-0905-79

## EDITED TRANSLATION

FTD-ID(RS)T-0905-79

2 July 1979

MICROFICHE NR: *FD-79-C-000 868*

LACQUERS AND PAINTS. METHOD FOR DETERMINING  
WEATHER-RESISTANCE OF COATINGS

English pages: 25

Source: GOST 6992-68, pp. 1-20

Country of Origin: USSR

Translated by: Joseph E. Pearson

Requester: AFML/MXA

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FTD -ID(RS)T-0905-79

Date 2 Jul 19 79

U. S. BOARD ON GEOGRAPHIC NAMES TRANSLITERATION SYSTEM

| Block | Italic     | Transliteration | Block | Italic     | Transliteration |
|-------|------------|-----------------|-------|------------|-----------------|
| А а   | <b>А а</b> | A, a            | Р р   | <b>Р р</b> | R, r            |
| Б б   | <b>Б б</b> | B, b            | С с   | <b>С с</b> | S, s            |
| В в   | <b>В в</b> | V, v            | Т т   | <b>Т т</b> | T, t            |
| Г г   | <b>Г г</b> | G, g            | Ү ү   | <b>Ү ү</b> | U, u            |
| Д д   | <b>Д д</b> | D, d            | Ф ф   | <b>Ф ф</b> | F, f            |
| Е е   | <b>Е е</b> | Ye, ye; E, e*   | Х х   | <b>Х х</b> | Kh, kh          |
| Ж ж   | <b>Ж ж</b> | Zh, zh          | Ц ц   | <b>Ц ц</b> | Ts, ts          |
| З з   | <b>З з</b> | Z, z            | Ч ч   | <b>Ч ч</b> | Ch, ch          |
| И и   | <b>И и</b> | I, i            | Ш ш   | <b>Ш ш</b> | Sh, sh          |
| Й й   | <b>Й й</b> | Y, y            | Щ щ   | <b>Щ щ</b> | Shch, shch      |
| К к   | <b>К к</b> | K, k            | ҃ ҃   | <b>҃ ҃</b> | "               |
| Л л   | <b>Л л</b> | L, l            | Ҥ Ҥ   | <b>Ҥ Ҥ</b> | Y, y            |
| М м   | <b>М м</b> | M, m            | Ԭ Ԭ   | <b>Ԭ Ԭ</b> | '               |
| Н н   | <b>Н н</b> | N, n            | Ҕ Ҕ   | <b>Ҕ Ҕ</b> | E, e            |
| О о   | <b>О о</b> | O, o            | Җ Җ   | <b>Җ Җ</b> | Yu, yu          |
| П п   | <b>П п</b> | P, p            | ҙ ҙ   | <b>ҙ ҙ</b> | Ya, ya          |

\*ye initially, after vowels, and after ѣ, є; е elsewhere.  
When written as ё in Russian, transliterate as yё or ё.

RUSSIAN AND ENGLISH TRIGONOMETRIC FUNCTIONS

| Russian | English | Russian | English | Russian  | English            |
|---------|---------|---------|---------|----------|--------------------|
| sin     | sin     | sh      | sinh    | arc sh   | sinh <sup>-1</sup> |
| cos     | cos     | ch      | cosh    | arc ch   | cosh <sup>-1</sup> |
| tg      | tan     | th      | tanh    | arc th   | tanh <sup>-1</sup> |
| ctg     | cot     | cth     | coth    | arc cth  | coth <sup>-1</sup> |
| sec     | sec     | sch     | sech    | arc sch  | sech <sup>-1</sup> |
| cosec   | csc     | csch    | csch    | arc csch | csch <sup>-1</sup> |

| Russian | English |
|---------|---------|
| rot     | curl    |
| lg      | log     |

UKD 620.197.6.001.4

Official edition

| USSR   | STATE STANDARD   | GOST<br>6992-68          |
|--|--|--------------------------|
| Committee of standards,<br>measures and measuring<br>instruments of the<br>Council of Ministers<br>of the USSR | Paint and lacquer materials<br>Method for determining cover<br>stability under atmospheric<br>conditions | Replaces<br>GOST 6992-60 |
|  | Lacquers and paints. Method<br>for determining weather-re-<br>sistance of coatings                       | Group L19                |

Noncompliance with this standard will be  
prosecuted in accordance with  
the law

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The present standard is propagated for paint and lacquer materials and establishes the method for determining the resistance of paint and lacquer coatings under atmospheric conditions.

The application of the method is specified in the standards and technical specifications, which take into account the technical specifications imposed on paint and lacquer materials.

#### 1. General Specifications

1.1 Tests are carried out on atmospheric platforms, located in industrial, nonindustrial and maritime-coastal regions under different climatic conditions: moderately continental, tropical, subtropical and Arctic.

##### 1.2 Atmospheric platform

1.2.1. An atmospheric platform should be located outside, on the roof of a

building or on the ground and is equipped with special stands.

1.2.2. The stands should be manufactured from a material, which does not effect the coatings being tested, and should be established on the atmospheric platform so, that the shadow of one stand does not fall on another.

The design of the stand should ensure free drainage of water. Plates with coatings on the lower series of stands are attached at a height of not less than 0.5 m above the roof and not less than 1 m above the ground.

1.2.3. Plates with paint and lacquer coatings are mounted on the stands at an angle of 45° to the horizon, with the face side to the south.

1.2.4. The test conditions of the plates with coatings on the atmospheric platform should be characterized by the average annual composition of the surrounding air and the following meteorological data, which are received monthly from the state meteorological stations or from a meteorological point at the atmospheric platform:

the temperature in °C (average, minimum, maximum); the amount of precipitation in mm;

the number of days with precipitation (rain, snow);

Introduced by the Ministry  
of the Chemical Industry of  
the USSR

Confirmed by the Committee of  
standards, measures and meter-  
instruments of the Council of  
ministers of the USSR Nov. 11,  
1968.

Time of intro-  
duction July  
1, 1968.

the number of days with a relative humidity in %: of 100-90; 90-70, 70 and lower;

the intensity of solar radiation (average and maximum) in cal/cm<sup>2</sup>.min and the number of hours of sun;

the average wind speed in m/s and its direction;

the air pressure (average) in mm;

the number of acute climatic changes and their character (hail, typhoon, etc.);

the pH of the precipitation;

the air pollution (for example, the content of SO<sub>2</sub>, CO<sub>2</sub>, dust)

### 1.3. PLATES FOR TESTING

1.3.1. Plates with dimensions of 210 x 297; 210 x 148 and 150 x 350 mm are employed for the atmospheric testing of paint and varnish coatings:

metal plates from pickled steel 0.9-1 mm thick in accordance with GOST 1386-47 or in accordance with GOST 8075-56:

metal plates from sheet annealed and pickled steel 0.9-1 mm thick, with a drawing depth of 8.2-9.9 mm;

wooden plates from hardwood and softwood lumber with a moisture of 9-13%, and 10-15 mm thick;

concrete plates, i. e., cement-sand (the ratio of cement, not lower than grade 400 and white river sand is 1 : 4);

vibratory-compacted concrete plates (1.5 s) 15-20 mm thick.

1.3.2. In the case of special testing it is permissible to use plates from other materials, not indicated in the present standard.

## 2. Preparation for Testing.

2.1. The steel plates are cleaned with a sandblasting or a shot-blasting device or manually with brushes or with sandpaper. After cleaning, the plates are washed with a solvent of the light benzine type and then dried. The cleanliness of a plate after cleaning and washing is checked with a cotton tampon, which should remain clean. If the metal plates are coated with mineral oil, then before mechanical cleaning they are degreased with a solvent (white spirit, benzine, etc.).

Between the time of the finishing of the cleaning and the beginning of the painting of the plates it is necessary that 4 h pass with the condition, that the plates are located at  $20 \pm 2^\circ\text{C}$  and at a relative air humidity of  $65 \pm 5\%$  or in a desiccator.

In testing special-purpose materials the plates can be prepared in accordance with the specifications established in the standards currently in effect or the

specifications for the paint-and-varnish material being tested, and when specifications are absent - in accordance with special instructions.

The backside and the faces of the metal plates are repainted and this affords anticorrosion protection.

2.2. The wooden plates should be planed and smoothed with sandpaper. When necessary, additional requirements for the preparing of wooden plates for testing can be indicated in special instructions. The back and the sides of the wooden plates should be protected against the penetration of moisture.

2.3. The back and the sides of concrete plates should be protected against the penetration of water.

2.4. Paint-and-varnish materials to be tested are applied to the plates and dried in accordance with the mode, established for them in the standards and specifications currently in effect, affirmed in the established order.

2.5. After the application and the practical drying of the paint-and-varnish material the plates with the coating are held for not less than seven days in a chamber at  $20\pm2^{\circ}\text{C}$  at a humidity of  $65\pm5\%$ . Before the exposure the measurement of the initial luster of the coating is conducted on the appropriate instrument. Then, identification marks are applied: in the lefthand corner - the sequence number is applied; in the righthand corner - the date on which exposure began is applied.

2.6. A control sample of the coating is simultaneously prepared on a plate

with dimensions of 150 x 60 mm for subsequent comparison with the coating being tested. The control sample is stored in a closed container at 20±2°C and at a relative humidity of 65±5%.

2.7. The order of exposing the plates with the coating on the atmospheric platform.

2.7.1. When placing and fastening plates with the coating on the stands it is necessary to observe the following conditions:

the contact of plates with one another and metal with metal is not permitted;

the stability of the fastening components to the effects of the atmosphere (the absence of corrosion);

the absence of points with concentrated mechanical load.

2.7.2. In zones with a moderately continental climate, it is recommended, that the plates with the coating be exposed in the March April period, and in tropical climate zones and in the Far North - it is recommended that they be exposed for the entire year.

2.7.3. For testing on the atmospheric platform, not less than three identical plates, simultaneously painted with one and the same paint-and-varnish material, should be exposed.

2.8. For each sample, exposed on the atmospheric platform, a chart is filled out, which is compiled in the form, indicated in appendix 1.

### 3. Conducting the Testing

3.1. The order of the inspection of the plates with the coating.

3.1.1. The plates with the coating are inspected in dispersed daylight in a chamber with windows facing north. The inspection is carried out by not less than two men.

#### Inspection periods:

during the first three months - once a month;

during the subsequent months up to two years - once every three months;

in each of the subsequent four months - once.

3.1.2. During the inspection, the degree of chalking of the coating is primarily determined, after which 50% of the surface of the plate with the coating is washed with warm water (not warmer than 30°C) with a soft sponge and is then air dried.

When necessary, the plates with the coating are washed with a 3% soap solution and rinsed with water.

During the subsequent inspections, the same part of the surface of the plate with the coating is washed.

3.1.3. During the inspection of the coatings, requiring maintenance, the washed surface of the plate with the coating is polished (treated with polishing water - a thin aqueous emulsion of a fine abrasive used for polishing).

### 3.2. DETERMINING AND CHECKING THE STABILITY OF A COATING UNDER ATMOSPHERIC CONDITIONS

3.2.1. During the inspection of the plates with the coatings, various types of breakdowns of the paint-and-varnish coating, indicated in appendix 2, are distinguished.

3.2.2. The degree of breakdown is expressed in percents of the total area of the plate with the coating. The percent of breakdown of the surface of the paint-and-varnish coating is determined in the following manner: a small plate of transparent material (organic glass, celluloid, etc.), on which a grid with square cells with sides of 10 mm is applied, is placed over the washed surface of the plate with the coating and the number of squares, in which one or another type of destruction is observed, is counted. The small transparent plate, placed over the plate with the coating, should be smaller than it in width and length by 10 mm.

The destruction of the surface of the paint-and varnish coating ( $X$ ) is calculated in percents with the following formula

$$X = \frac{n_1}{n} \cdot 100,$$

where:

$n_1$  is the number of squares, in which one or another type of destruction is

observed;

n is the number of squares on the small transparent plate.

3.2.3. The results of the inspection are recorded on a chart, compiled in the form, indicated in appendix 3.

3.2.4. The stability of the paint-and-varnish coatings are determined with respect to the decorative form and the protective properties.

3.2.5. The stability of the decorative form of the coating under atmospheric conditions is determined in accordance with a five number scale, presented in Table 1, and the determination of the protective properties - in accordance with an eight number scale, presented in Table 2, and are designated respectively with Roman and Arabic numbers.

3.2.6. If any one type of breakdown is observed on a coating, then the coating is assigned a number, which corresponds to this type of breakdown.

3.2.7. If several types of breakdown are observed on a coating, to which different numbers correspond, then a lower number is assigned to the coating

3.2.8. The stability of a coating under atmospheric conditions is designated by two numbers, for example, IV. 7.

Table 1

| 2<br>Баллы    | 1 Виды разрушений                     |                   |  |                 |                  |
|---------------|---------------------------------------|-------------------|--|-----------------|------------------|
|               | 3 Потеря блеска в %                   | 4 Изменение цвета | 5 Бронзировка                            | 6 Белесоватость | 7 Гравеудержание |
| V<br>До 5     | 10 Едва заметное                      |                   |  | 15 Отсутствие   |                  |
| IV<br>До 20   | 11 Незначительное                     |                   | 11 Незначительная                        |                 | Незначительное   |
| III<br>До 50  | 12 Значительное                       | 12 Значительная   | 16 Значительная.<br>Пятна местами        |                 | Значительное     |
| II<br>До 80   | 13 Сильное                            | 19 Сильная        | 17 Сильная. Пятна по всей<br>поверхности | 13 Сильное      |                  |
| I<br>Свыше 80 | 17 Полная потеря основ-<br>ного цвета | 18 Сильная        | 18 Сильная. Пятна по<br>всей поверхности | 13 Сильное      |                  |

Key: 1 - Types of Breakdowns; 2 - Numbers; 3 - Loss of luster in %; 4 - Color change; 5 - Bronzing; 6 - Whitishness; 7 - Contaminant containment; 8 - Up to; 10 - Hardley noticeable; 11 - Insignificant; 12 - Significant; 13 - Intense; 14 - Complete loss of basic color; 15 - Absence; 16 - Significant. Spots in places; 17 - Intense. Spots over the entire surface; 18 - Intense. Spots over the entire surface.

Table 2

| Виды | Виды разрушения             |  |  |   |   |  |
|------|-----------------------------|--|--|---|---|--|
|      | Мелкие                      | Выветривание   | Рострекивание  | Отслаивание   | Пузыри, сильн.  |  |
| 8    | <i>11</i> Отсутствие        |  |  |   |   |  |
| 7    | Едва заметное               | <i>12</i> Отсутствие   |  |   |   |  |
| 6    | Слабое<br><i>10</i>         | Отсутствие <i>11</i>   | <i>12</i> Трещины или поверхностные сетки, видимые при 12-кратном увеличении   | <i>13</i> Отсутствие                                      |   |  |
| 5    | Незначительное<br><i>12</i> | Отсутствие <i>11</i>   | Трещины или поверхностные сетки, видимые невооруженным глазом, до 5% поверхности   | <i>14</i> Отсутствие                                      |   |  |
| 4    | Среднее<br><i>13</i>        | Отсутствие <i>11</i>   | То же, до 25% поверхности<br><i>21</i>   | Отсутствие <i>11</i><br><i>22</i>                         | <i>28</i> Сыль до 25% поверхности. Пузыри до 5% поверхности<br><i>32</i> Отдельные точки        |  |
| 3    | Значительное<br><i>14</i>   | Верхнего слоя до 5% поверхности<br><i>17</i>                         | Трещины или поверхностные сетки, видимые невооруженным глазом, до 50% поверхности. Глубокие трещины до 5% поверхности<br><i>22</i> | Верхнего слоя до 5% поверхности<br><i>25</i>              | <i>29</i> Сыль до 50% поверхности. Пузыри до 5% поверхности<br><i>33</i> До 5% поверхности      |  |
| 2    | Сильное<br><i>15</i>        | До просвечивания грунта или подложки до 10% поверхности<br><i>18</i> | То же, свыше 50% поверхности. Трещины до 10% поверхности<br><i>23</i>  | От грунта или от подложки до 10% поверхности<br><i>26</i> | <i>30</i> Сыль свыше 50% поверхности. Пузыри до 10% поверхности<br><i>34</i> До 10% поверхности |  |
| 1    | Очень сильное<br><i>16</i>  | То же, свыше 10% поверхности<br><i>19</i>                            | То же, глубокие трещины свыше 10% поверхности<br><i>27</i>   | То же, свыше 10% поверхности<br><i>29</i>                 | <i>31</i> То же, пузыри свыше 10% поверхности<br><i>35</i> Свыше 10% поверхности                |  |

Key: 1 - Types of breakdowns; 2 - Numbers; 3 - Chalking; 4 - Weathering; 5 - Cracking; 6 - Peeling; 7 - Bubbles, eruption; 8 - Corrosion; 9 - Hardley noticeable; 10 - Weak; 11 - Absence; 12 - Cracks of surface networks, visible at 12-fold magnification; 12A - Continuation; 13 - Average; 14 - Significant; 15 - Intense; 16 - Very intense; 17 - Of the Upper layer up to 5% of the surface; 18 - So that the primer or the base is visible over 10% of the surface; 19 - The same, but more than 10% of the surface; 20 - Cracks of surface networks, visible to the unaided eye, up to 10% of the surface; 21 - The same, but up to 25% of the

Key to Table - contd. 21 - contd. - surface; 22 - Cracks or surface networks, visible with the unaided eye, up to 50% of the surface. Deep cracks over up to 5% of the surface; 23 - The same, over more than 50% of the surface. Cracks over up to 10% of the surface; 24 - The same, deep cracks over more than 10% of the surface; 25 - Of the upper layer over up to 5% of the surface; 26 - From the primer or from the base over up to 10% of the surface; 27 - The same, over up to more than 10% of the surface; 28 - Eruption over up to 25% of the surface. Bubbles over up to 5% of the surface. 29 - Eruption over more than 50% of the surface. Bubbles over up to 10% of the surface. 31 - The same, bubbles over more than 10% of the surface. 32 - Individual points. 33 - Over up to 5% of the surface. 34 - Over up to 10% of the surface. 35 - Over more than 10% of the surface.

#### Appendix 1

##### Sample No.

|   |  |
|---|--|
| 1. Name and formula of material being tested.   | Atmospheric platform                                       |
| 2. Where obtained.  | city _____.  |
| 3. Purpose of the work.   | Height above sea level.                                    |
| 4. Purpose of the material.   | Meteorological data (in accordance with paragraph 1.2.4.). |
| 5. What material is it recommended to replace.  | Characteristics of the composition of the surrounding air. |
| 6. Plate material.  |  |
| 7. Method of cleaning the plate.  |  |
| 8. Painting technology:<br>drying temperature in °C.<br>drying time in min (h).<br>thickness of layer in $\mu$ .<br>number of layers.<br>method of application. |  |
| 9. By whom the work was done.   |  |
| 10. Date of the beginning of the exposure.  |  |
| 11. Date of the end of the exposure.  |  |
| 12. Preparation of the samples before inspection (washing with water, polishing, etc.).   |  |

#### Appendix 2.

##### Types of Breakdowns of a Paint-and-Varnish Coating

Loss of luster. Loss of luster is one of the indices of the initial stage of the breakdown of the surface layer of a coating as a result of photochemical

processes. Loss of luster is determined with the aid of a photoelectric brightness meter or visually by comparison with a control sample.

Change in color. A change in the color of paint-and-varnish coating (whitening, darkening, yellowing) occurs as a result of photochemical processes. The degree of the color change in a coating being tested is determined with the aid of photoelectric colorimeters, spectrophotometers or visually by comparison with a control sample.

Bronzing. Bronzing occurs as the result of the migration of pigment and is characterized by the appearance of an iridescent tarnish on the surface of the paint-and-varnish coating.

Whitishness. Whitishness is a deposit on the surface of a coating, formed as a result of physicochemical processes and the effect of moisture. In its initial stage whitishness is removed by treating with polishing water.

Contamination containment. Contamination containment is the ability of a paint-and-varnish coating to retain on its surface mechanical contaminants, which are not removed by washing water.

Chalking. (Figures 1-4). Chalking is the the surface breakdown of a pigmented paint-and-varnish coating, which takes place as a result of photochemical processes and is accompanied by the formation of free pigment particles, which are easily removed from the surface.

The degree of chalking is determined by the character and the amount of pig-

freely separated from the surface of the coating by rubbing with a cloth (flannel): black - for light-colored coatings, and white - for dark-colored coatings.

The following types of chalking are distinguished:

hardly noticeable;

insignificant - upon rubbing with a cloth the color and the luster of the coating are immediately restored;

significant - in colored coatings it is accompanied by intense fading, and upon rubbing with a cloth the color and the luster of the coating are restored;

intense - upon rubbing with a cloth the color and luster are restored with great difficulty.

The degree of chalking of a coating is also determined by the Kempf method by an impression of the chalking layer, taken by means of a special instrument on photographic paper.



Fig. 1

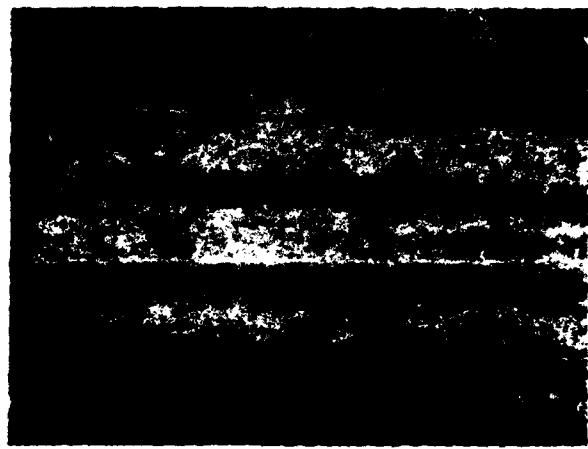


Fig. 2.



Fig. 3.

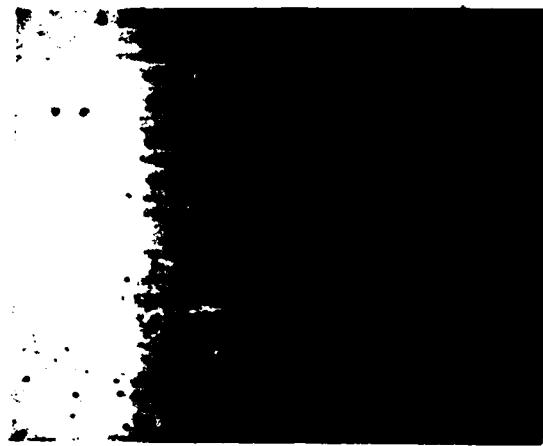


Fig. 4.

Weathering (Fig. 5 and 6). Weathering is the process of the breakdown of a coating as a result of erosion, which causes wearing of the upper layer of the coating. The greatest degree of weathering is characterized by the baring of the primer or the metal (or another base).

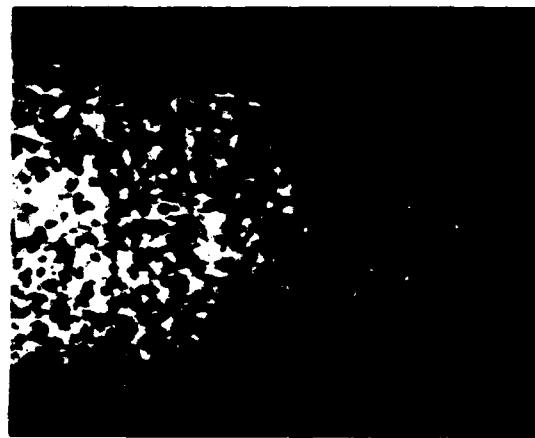


Fig. 5.



Fig. 6.

Cracking. (Fig. 7-10). Cracking is the consequence of the loss of mechanical strength by a coating as a result of its aging. In this case, cracks and networks form.



Fig. 7

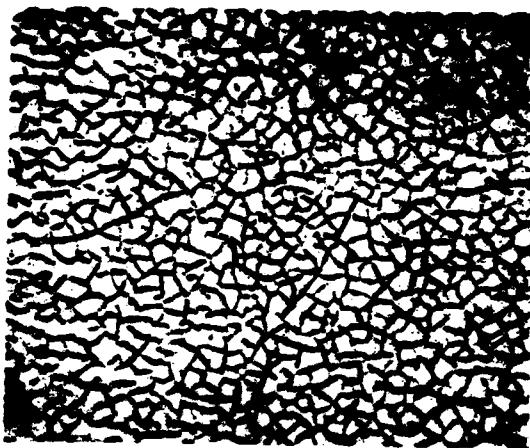


Fig. 8.



Fig. 9.



Fig. 10.

Peeling. (Fig. 11-14). Peeling of a coating occurs due to the disruption of its adhesion with the painted surface or with an underlying layer of paint or the priming layer.



Fig. 11.



Fig. 12.

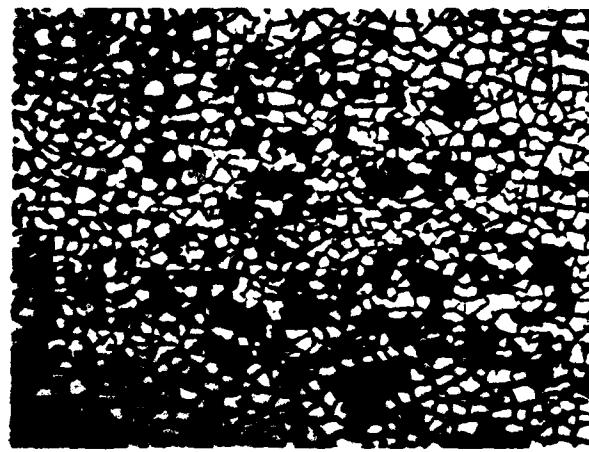


Fig. 13.



Fig. 14.

Eruption (Fig. 15) and bubbles (Fig. 16-18). Eruption and bubbles form on the surface of a coating mainly due to the effect of moisture and its penetration under the film.



Fig. 15.

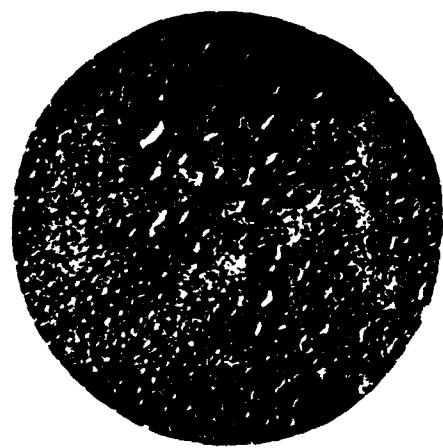


Fig. 16.

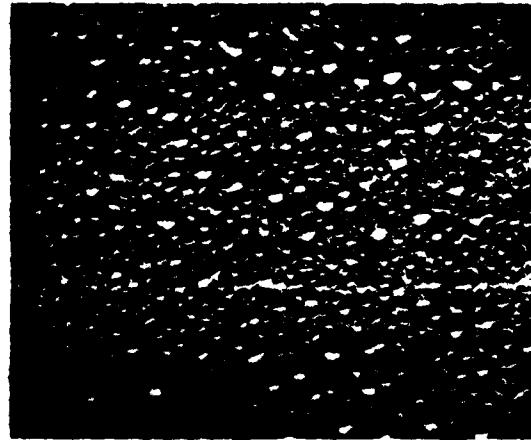


Fig. 17.

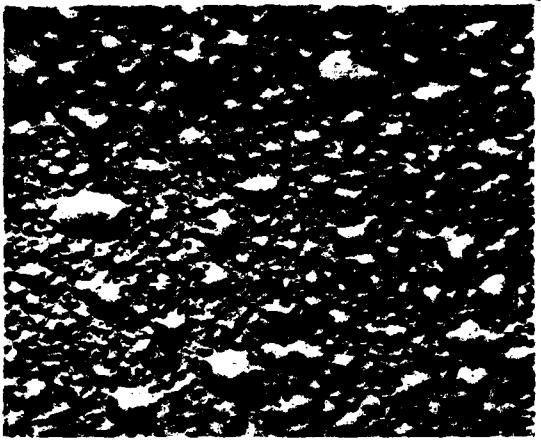


Fig. 18.

Corrosion. (Fig. 19-22). The appearance of corrosion on the surface of a coating attests to the breakdown of the painted metal. The presence or the absence of subfilm corrosion is determined by removing the coating at several sites only upon completion of the exposure or upon expiration of the guarantee period of the weatherproof coating.



Fig. 19.



Fig. 20.

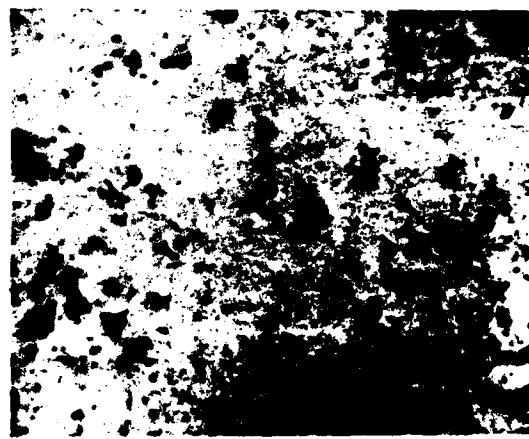


Fig. 21.



Fig. 22.

Appendix 3.

| Вид разрушения   | 1 Дата осмотра (число, месяц, год) и оценка в баллах |   |   |   |   |   |   |   |    |    |
|--|--|---|---|---|---|---|---|---|----|----|
|  | 2  | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| Потеря блеска<br>Изменение цвета<br>Бронзировка<br>Белесоватость<br>Грязеудержание<br>Мелсние<br>Выветривание<br>Растрескивание<br>Отслаивание<br>Пузыри, сыпь<br>Коррозия |  |   |   |   |   |   |   |   |    |    |

Key: 1 - Date of inspection (number, month, year) and evaluation in rating numbers; 2 - Type of breakdown; 3 - Loss of luster; 4 - Change in color; 5 - Bronzing; 6 - Whitishness; 7 - Contaminant retention; 8 - Chalking; 9 - Weathering; 10 - Cracking; 11 - Bubbles, eruption; 12 - Corrosion.

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